Forest Research Notes

Northeastern Forest Experiment Station

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NEMATODES INHABIT SOILS OF FOREST AND CLEAR-CUT AREAS

Nematodes are present in all forest soils, but their effects on forest trees are not known. The known destructive nature of these worms on other woody crops suggests that they may also be involved in causing some of the unexplainable losses in vigor and mortality of forest trees.

Nematodes are unsegmented roundworms. They comprise 99 percent of the animal forms larger than protozoa in the soil. Many nematodes are not plant parasites; but approximately 150 species do feed on higher green plants. Some species are capable of destroying large fields of different crops. All known plant-parasitic nematodes have a stylet in their anterior end, which is used for puncturing plant cells and sucking out the cellular contents. Most of these parasites have a large host range. Nematode diseases of woody ornamentals, fruit trees, and forest tree seedlings in the nurseries are known. Many plant diseases are incited by fungus-nematode complexes.[1]

Soil conditions and species of green plants growing in any area affect nematode populations. The clear-cutting of a small area in an established forest causes changes in soil conditions, and species of green plants not common in the forest abound in these cleared areas.

A study was made on the Bartlett Experimental Forest in New Hampshire to determine whether there was a difference between the types and numbers of nematodes inhabiting the soils in small clear-cut areas and the adjacent forest.

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[1]For a detailed account of nematodes, see Christie, J. R. Plant nematodes, their bionomics and control. 256 pp. Drew Co., Jacksonville, Fla. 1959.

Materials And Methods

Ten soil samples were collected from four selected clear-cut areas, each approximately 2/3 acre. A similar number of samples were collected from the forest. The samples (5 pounds each) were collected at random from the upper 8 inches of soil, in plastic bags. Each bag was securely tied, assuring an air-tight seal. All collections were made on November 10, 1959.

The soil from each sample was passed through an 8-mesh screen, and five subsamples were selected from each sample, each containing 25 ml. of loose soil. Each subsample was poured into a nematode-trapping apparatus.

The nematode traps (fig. 1) were made of common waxed-paper drinking containers.[2] Three types of containers were used. An inverted 5-inch cup with the bottom cut out (A) served as a support. A cone cup (B) was placed on this, and was filled with water to within $\frac{1}{4}$ inch of the top. The top unit (C) was made of two bottomless $\frac{1}{2}$-pint cups, with wet-strength paper tissue held taut between them to form a tissue bottom.

The soil sample was poured into this top unit, which was then placed gently into the water-filled cone. The active nematodes were washed from the soil; and after maneuvering through the tissue they fell to the bottom of the water-filled cone. After 24 hours the bottom $2\frac{1}{2}$ ml. was pipetted from each cone and poured into Syracuse glasses divided into nine sections on the outside bottom surface with a marking pencil. The nematodes were counted under low power (9X) of a dissecting microscope.

After being counted, the nematodes from the clear-cutting and forest samples were placed in separate containers. The bottom 5 ml. of each container was pipetted into a Syracuse glass. Twenty-six water mounts were examined from each collection. The number of nematodes on each slide was recorded, and all stylet-possessing forms were recorded and identified by genus.

Results

There were great differences among the total numbers of nematodes contained in all soil samples, but the subsamples from each sample were always fairly consistent in their nematode numbers. More nematodes were contained in the 50 subsamples (24,933) from the clear-cutting than in the 50 forest subsamples (15,525).

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[2]The nematode-trapping apparatus described was perfected by members of the Plant Pathology Department at West Virginia University.

Figure 1.--*The nematode trapping apparatus made of waxed-paper containers. A, the support; B, cone, filled with water; and C, top unit, consisting of two cups holding a diaphragm of wet-strength paper tissue. The nematodes, washed out of soil samples, work their way through the tissue diaphragm and are collected in the bottom of the cone.*

The amount of organic matter and the moisture content in the clear-cutting samples were lower than in the forest samples.

The 52 water mounts made from the 100 subsamples contained mostly freeliving forms. Samples from the clear-cuttings contained more of these forms than those from the forest. Species of Rhabditus were most common. Seven other genera of freeliving forms were observed.

A total of 1,500 nematodes were counted in the water mounts from the forest samples and 37 percent were stylet-possessing forms. The stylet-possessing forms made up 27 percent of the 1,687 nematodes counted in the water mounts from the clear-cutting samples.

The majority of the stylet-possessing forms responsible for the high count from the forest samples were tentatively identified as Aphelenchoides sp. Many of these nematodes were not mature. A total of 404 Aphelenchoides sp. were counted in the water mounts from the forest samples, and 233 from the clear-cutting samples.

A species of Dorylaimus was common in all the water

mounts; 129 were counted from the clear-cutting samples and 114 from the forest samples.

A greater variety and number of other stylet-possessing nematodes were observed in the water mounts from the clear-cutting samples (96) than from the forest samples (39). Among the genera observed were *Pratylenchus*, *Rotylenchus*, *Ditylenchus*, *Criconemoides*, *Tylenchorhynchus*, *Tylenchus*, and *Helicotylenchus*.

Discussion

Although a very small sampling was used in this investigation, it is of interest to conjecture that 37 percent of the 15,525 nematodes counted from the 50 forest subsamples and 27 percent of the 24,933 nematodes counted from the 50 clear-cutting subsamples were possible plant parasites. The number of possible plant parasites from the clear-cutting subsamples (6,732) would then be greater than the number from the forest subsamples (5,744). Since each subsample contained 25 ml. of soil, 50 subsamples would contain 1,250 ml., or $1\frac{1}{4}$ liters of soil. So the possibility exists that several thousand possibly plant-parisitic nematodes are present in every quart of soil in the forest areas sampled.

It should be pointed out that a nematode with a stylet does not necessarily indicate that it is a parasite on higher plants. Many nematodes possessing a stylet feed on fungi, algae, and other nematodes. Since some species of *Aphelenchoides* and *Dorylaimus* are not plant parasites, care was taken in this note not to insinuate that all species possessing a stylet are plant parasites. Conversely, some freeliving forms, especially *Rhabditus* spp., have been associated with damping-off because they have been found inside seedling roots soon after disease symptoms were observed.

The results suggest that there are differences in numbers and types of nematodes between the two areas. Soil conditions and species of green plants in the clear-cuttings differed from those in the forest. The large numbers of nematodes in the clear-cuttings may have been the result of these differences.

Because of the possible effect of nematodes on forest trees, it seems that further research on nematodes in forest soils would be worth while.

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